Space Weather Technical Forecast

Issued on Thursday, 03 February 2022 at 01:17 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of G1/Minor Storms late day 2 into day 3 (4th/5th). Chance of M-class flares (R1/R2 Radio Blackouts) throughout.
Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Low with a number of C-class flares observed. The largest being a C7.8 at 02/1036 UTC from AR2939, but this region has seen decay in its trailing portion since then and is now classified as Cho/Beta. AR2936 (Ehi/Beta) in the northwest quadrant is the largest region on visible disc and has shown little change during the past 24 hours. AR2940 in the northeast is the next largest region and has continued to develop to become Esi/Beta. The final region currently on the disc is A2938 which remains a simple Bxo Beta, with signs of decay.
No Earth directed CMEs were observed in the available imagery during the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1, reflects the declining influence of a CME which left the Sun on the 29th January. Solar winds have been slightly elevated but gradually declining from around 480 km/s to around 420 km/s. Density has been average to slightly above average, between 5 and 20 ppcc. The magnetic field was initially moderate, 9-13 nT, but became weak from 02/0400 UTC. However, since 02/2015 UTC it has increased to moderate again. Bz has generally been weakly positive, but a period of -4 to -7nT Bz was observed 02/1340-1545 UTC. Initially the phi angle was fluctuating in association with the arrival of the CME, but has been in a largely positive (away from the Sun) orientation since 02/1000 UTC. Geomagnetic activity was mainly Quiet to Unsettled (Kp 1-3), but an Active (Kp 4) interval was observed 02/0000-0300 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at background levels. The high energy electron flux (greater than 2MeV), diurnally fluctuated between background and moderate levels, with a peak value of 900 pfu at 02/1645 UTC. The associated 24-hour electron fluence has decreased through the period from 7.1e7 integrated pfu at 02/0000 UTC to 1.1e7 integrated pfu at 03/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Low, with further C-class flares, a chance (30%) of M-class flares and a very slight chance (5%) of an X-class flare. Most likely from AR2936 (Ehi/Beta), AR2939 (Cho/Beta) or AR2940 (Esi/Beta).

Solar Wind / Geomagnetic Activity: Slightly elevated solar winds are expected to decline to ambient levels on day 1 (3rd), as weak CME influences wane. Solar winds may become elevated later on day 2 (4th), but more likely on day 3 (5th), due to coronal hole 49 (CH49). Winds are likely to remain enhanced on day 4 (6th). Quiet to Unsettled geomagnetic activity is generally expected, but with a chance of Active intervals early on day 1 (3rd) and late day 2 into day 3 (4th/5th). There's also a slight chance (10-20%) of a G1/Minor Storm interval in association with the arrival of CH49.

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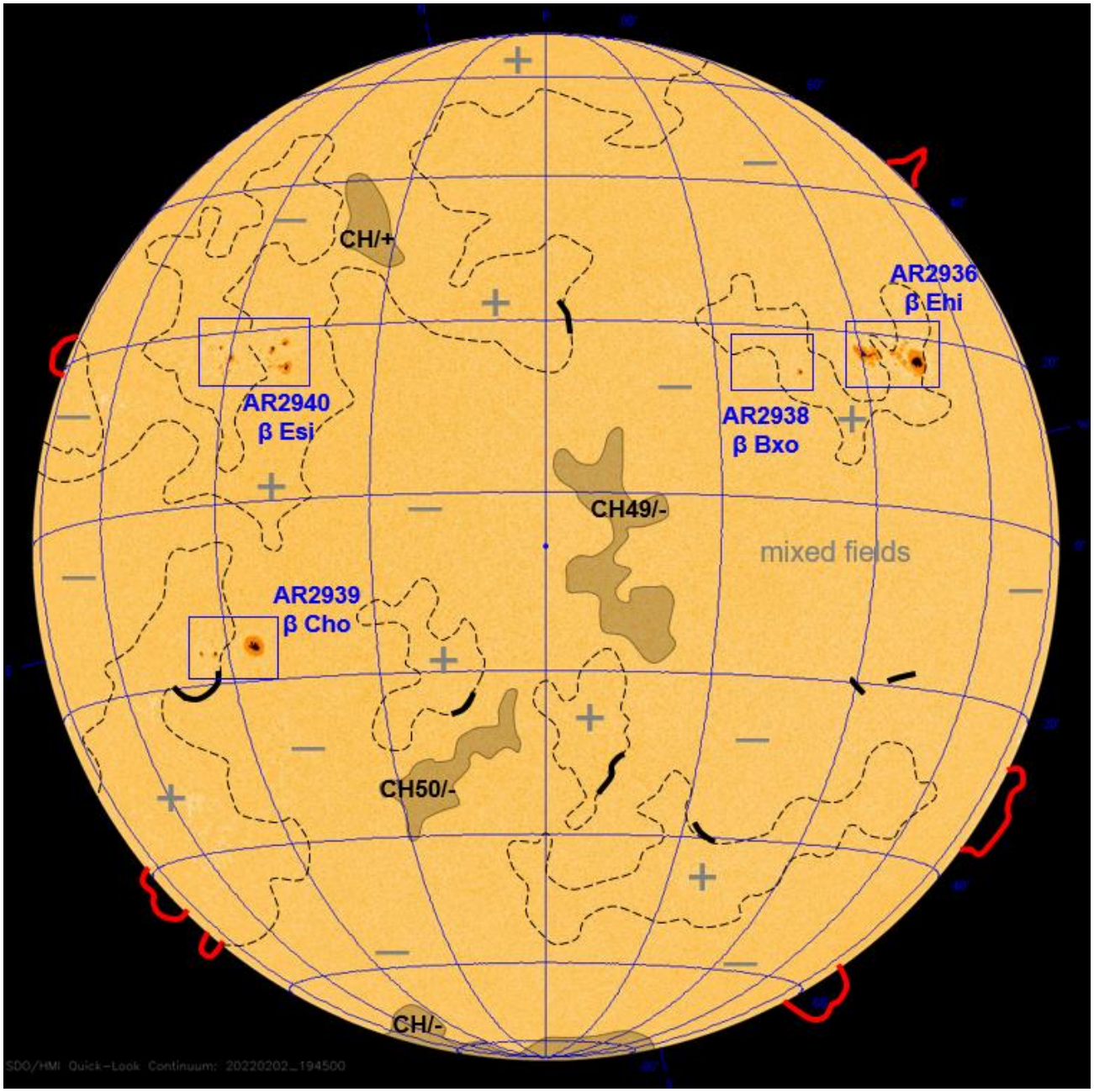
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is forecast to be at background levels but with a slight chance of rising close to or just above the S1 level given any significant M-flaring, predominately from AR2936. The high energy electron flux (greater than 2MeV) is likely to remain at background to moderate levels through much of this, but may become High (>1e3 pfu) during diurnal peaks. The electron fluence is likely to remain below the Active (1e8 integrated pfu) threshold, but with a rising trend on days 1, 2 and 4 (3rd, 4th and 6th).

Figure 1. Solar Analysis Valid 02/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A full halo CME from the 29th January arrived at Earth late on the 1st February. Solar winds are currently slightly enhanced from this feature but should decline to ambient levels through day 1 (3rd) as the influence of the CME continues to wane. Solar winds may become elevated later on day 2 (4th), but more likely day 3 (5th), due to coronal hole 49 (CH49) moving into a geoeffective position.
Geomagnetic activity is expected to be Quiet to Unsettled, with a chance of Active intervals early on day 1 (3rd) and late on day 2 (4th) into day 3 (5th). There's also a slight chance (10-20%) of a G1/Minor Storm interval in association with the arrival of the corotating interaction region (CIR) and high speed stream (HSS) from CH49.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	10	20	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil

Radio Blackouts - X-Ray Flares:

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Solar activity has been Low over the past 24 hours, with frequent low level C-class flares. A larger C7.8 flare occurred at 02/1036 UTC from AR2939 (Cho/Beta). There are two other larger regions on the visible disc that are also likely to be sources of significant flare activity over the coming days; AR2936 (Ehi/Beta) in the northwest quadrant and AR2940 (Esi/Beta) in the northeast quadrant. Finally there are some bright regions on STEREO-A EUVI imagery, possibly EX2929 and EX2930, that are forecast to rotate on to the visible disc later on day 2 (4th). These were regions of note on previous rotation, but will require further assessment as they come into view.
Solar activity is therefore expected to remain predominantly Low through the forecast period, with further C-class flares, a chance (30%) of M-class flares and a very slight chance (5%) of an X-class flare.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux, as measured by GOES-16 is at background levels. Solar radiation storms are not likely in the period, however there is a slight chance (5%) for proton fluxes to rise given any significant flaring, predominately from AR2936 in the northwest quadrant.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) is currently at moderate to background levels, but may rise to High (1e3 pfu) levels during its diurnal peak in response to the recent slightly elevated solar winds. A reduction is likely on day 3 (5th) due to increased geomagnetic activity in association with the arrival of the high speed stream from CH49, before rising towards High levels again on day 4 (6th). The corresponding electron fluence is likely to exhibit a rising trend on days 1, 2 and 4 (3rd, 4th and 6th), but the Active threshold (1e8 integrated pfu) is unlikely to be breached.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	10	20	20	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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